STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES
AND ENVIRONMENTAL CONTROL
89 KINGS HIGHWAY
DOVER, DELAWARE 19901

Office of the Secretary

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Secretary's Order No. 2009-A-0005

Re: Approval of Final Plan of Remedial Action for Hay Road, City of Wilmington (DuPont Company Iron Rich Staging Area/Hay Road Sludge Drying Site at Cherry Island)

Date of Issuance: January 16, 2009
Effective Date: January 16, 2009

Under the authority granted the Secretary of the Department of Natural Resources and Environmental Control ("Department" or "DNREC") under *7 Del C.§6003*, the following findings, reasons and conclusions are entered as an Order of the Secretary. This Order considers the Proposed Plan of Remedial Action, dated December 14, 2004 ("Plan"), which the Department's Division of Air and Waste Management's ("DAWM") Site Investigation and Restoration Branch ("SIRB") prepared.

SIRB prepared the Plan pursuant to the Delaware Hazardous Substance Cleanup Act *7 Del. C. Chapter 91*. The intent of the plan is to allow environmental remediation to take place on approximately 22.7 acres ("Property") owned by DuPont de Nemours & Company ("DuPont") located on Hay Road in an area known as Cherry Island in Wilmington, New Castle County, Delaware. The Property is approximately one mile south of DuPont's titanium dioxide[1] ("TiO2") manufacturing facility at 104 Hay Road, Edge Moor, New Castle County.

[1] The white pigments are used in paints, paper and a number of other household products

The Property has been used for sludge drying and beginning in 1997 for stockpiling or storage of a byproduct of its TiO2 process which DuPont marketed as a soil substitute under the trade name Iron Rich© material ("IRM"). Approximately 500,000 tons of IRM remain on the Property.

As a result of federal regulatory changes affecting the classification of IRM which were also adopted by the State, compliance and environmental issues were raised regarding IRM. To resolve these issues the Department initiated an enforcement action that resulted in Superior Court approving a consent decree that directed DuPont to enter into an agreement with SIRB under its Voluntary Cleanup Program. The Order also included a provision that the environmental remedy would allow the IRM to remain in place.

SIRB issued the Plan on December 14, 2004, and held a public hearing March 2, 3 and 9, 2005 to receive comments on the Plan. Most of the comments proposed extracting the IRM and transporting it to a suitable disposal site.

The Delaware General Assembly passed House Concurrent Resolution No. 22, which sought an independent study of Property in order to assist in determining whether the Plan should be adopted or modified. The Department retained Schnabel Engineering North LLC ("Schnabel"), which submitted its independent study in a report dated December 20, 2006 ("Study"). On February 1, 2007, the Department published notice that the public comment period was extended to allow comments on the Study. The subsequent technical work, including significant field sampling and data analysis occurred during 2007 and 2008, resulting in a Remedial Investigation/Risk Assessment Addendum report in December 2008.

The presiding hearing officer requested the technical assistance of SIRB to assist in the technical analysis, and SIRB provided a technical response memorandum, dated January 14, 2009, a copy of which is appended hereto ("SIRB Memo"). The hearing officer has reviewed this technical response SIRB Memo from the program staff, and found that it adequately addresses the public comments as well as the issues subsequently raised through the Independent Study performed by Schnabel Engineering, Inc., per HCR #22. The Department's presiding hearing officer issued a Report dated January 16, 2009, a copy of which is attached hereto, that recommends approval of the Plan with certain modifications for further study.

The subsequent study performed in the wake of the public hearings and HCR#22 found that the site presents a lower risk than initially believed, and that the proposed remedy is a fully protective remedy based on the most conservative assumptions about the site and potential risks. The assessment did, however, raise questions about the potential environmental impact from the dredge spoils under the IRM and from other nearby locations along the Delaware River. These should be addressed in a future investigation of this and other sites along the Shellpot Creek and Delaware River. Overall, the proposed remedy will ensure, with an ample margin of safety, that the site will not pose any significant risk to the environment or public health with the possible exception of ecological impacts from the underlying dredge material located throughout the area. Finally, the public comments were found not be based on facts after review over the past four years since the passage of HCR 22.

Based upon the Report and the SIRB Memo, I agree that the Plan's cap-in-place remedy should be adopted, but that the Plan should also include the following:

1) A broader area-wide groundwater monitoring program to allow increased evaluation of the hydrogeology and chemistry of the underlying dredge material and groundwater to determine the potential impact to the surrounding environment, including Shellpot Creek. The potential impacts may include ecological impacts to natural resources. No undue public health risks appear to exist from these contaminants. This groundwater evaluation effort should include not only the Property, but include other sites where similar dredge material may have been placed.

2) The site-related contaminants present in the Shellpot Creek along with the contaminants from other sources may be addressed through the Shellpot Creek initiative, Delaware Estuary Program and DNREC's Natural Resource Damage Assessment.

The amount of time and effort spent in this environmental investigation has surpassed any in the Department's recent memory. The Schnabel Report identified certain areas where additional information should be gathered and evaluated and this additional information was provided to the Department.

In sum, as more fully described in the reasons and findings above and in the Report, I adopt and direct the following as a final order of the Department:

1. The Department has jurisdiction under its statutory authority to make a determination in this proceeding;

2. The Department provided adequate public notice of the proceeding and the public hearing in a manner required by the law and regulations;

3. The Department held a public hearing in a manner required by the law and regulations;

4. The Department considered all timely and relevant public comments in making its determination;

5. The Department shall issue the Final Plan of Remedial Action based upon the Proposed Plan of Remedial Action, except as noted in the changes made in response to the public hearing process; and

6. The Department shall provide notice of this action by publication of notice in the same manner as provided for the publication of notices for the Proposed Plan and the public hearing, and provide such notice to others as may be determined by the Department.

s/John A. Hughes
John A. Hughes
Secretary

HEARING OFFICER'S REPORT

TO: The Honorable John A. Hughes
Secretary, Department of Natural Resources and Environmental Control

FROM: Robert P. Haynes, Esquire
Senior Hearing Officer, Office of the Secretary
Department of Natural Resources and Environmental Control

RE: Proposed Plan of Remedial Action for Iron Rich© Material Staging Area/Hay Road Sludge Drying Site at Cherry Island, City of Wilmington, New Castle County

DATE: January 16, 2009

I. BACKGROUND AND PROCEDURAL HISTORY

This Report is submitted to the Secretary of the Department of Natural Resources and Environmental Control ("Department" or "DNREC") as recommendations on a Proposed Plan of Remedial Action prepared under the Department's authority in the *Delaware Hazardous Substance Cleanup Act, 7 Del. C. Chapter 91* ("HSCA"), and the Department's regulations *Delaware Regulations Governing Hazardous Substance Cleanup.*

On December 14, 2004, the Department's Division of Air and Waste Management ("DAWM"), Site Investigation and Restoration Branch ("SIRB") issued a Proposed Plan of Remedial Action. ("Plan"). The Plan was for the environmental remediation of approximately 22.7 acres ("Property") owned by E.I. Du Pont de Nemours and Company ("DuPont") located at Hay Road in an area known as Cherry Island [1]within the City of Wilmington, New Castle County.

The Property is part of a 108 acre tract that DuPont purchased in 1958 from American Dredge Company, which used the property to place dredge spoils from the United States Army Corps of Engineers' Delaware River dredging. The Property is bordered by the Delaware River to the east, Shellpot Creek to the north, East 12 Street Extended to the south and DuPont's

[1]Based upon photographic evidence, until the construction of a seawall in the Delaware River circa 1927, the Delaware River's bank was adjacent to Hay Road. The Property appears to have been created from dredge spoils.

Cherry Island Landfill to the west, which is an industrial solid waste landfill that DuPont closed in 1996. The Property is approximately one mile south of DuPont's titanium dioxide ("TiO2") white pigment manufacturing facility at 104 Hay Road, Edge Moor, New Castle County ("DuPont Edge Moor"). DuPont Edge Moor used the Property for drying wastewater treatment sludge and had planned to build another landfill cell on the Property for disposal of its solid waste.

In 1992, the DuPont's Edge Moor plant changed it manufacturing process, which, in turn, produced a new byproduct from the process' spent coke and iron ore solids. DuPont sought to market the byproduct as a low-permeable soil substitute material for landfills, berms, and other similar uses. DuPont patented and copyright protected the byproduct under the trade name Iron Rich©, which DuPont intended to allow the recycling of most of DuPont Edge Moor's solid waste into usable product. DuPont used the material to cap its Cherry Island Landfill's three cells from 1992 through 1996, and in 1997 began placing the Iron Rich© material ("IRM") on the Property for temporary storage, or stockpiling, pending its distribution to customers. At this time DuPont began to call the Property the Iron Rich Staging Area.

Approximately 100,000 tons of IRM were stored annually at the Property between 1997 and 2001. In 1993, DuPont received the Department's Secretary's award in recognition of IRM's environmental benefit from waste minimization. Approximately 500,000 tons of IRM remain on the Property.

The United States Environmental Protection Agency ("EPA") changed its regulations in 2001 that, if adopted by Delaware, would result in the end of any sale of IRM. The Department adopted the EPA regulation that classified the IRM as a K178 listed material. DuPont and the Department entered into settlement negotiations during this time in an effort to resolve the Property's environmental issues raised by the classification. In order to implement a settlement, the Department filed an enforcement action in the Superior Court of Delaware in C.A. 01c-10-

288CHT, which on November 2, 2001 approved a consent decree. Under this court order, DuPont was to enter into the Department's Voluntary Cleanup Program ("VCP"), as administered by SIRB, and that the IRM was to have an environmental remedial action to allow the IRM to remain in place at the Property.

On April 9, 2002, DuPont submitted to SIRB a proposal for an interim measure that would re-grade the IRM and reduce its footprint from 22 acres to 15.9 acres, and to apply a polymer coating to the surface of the IRM in order to prevent windblown migration of IRM. SIRB approved the proposed interim measure in an April 18, 2002 letter. On September 11, 2002, SIRB and DuPont entered into a VCP agreement that included SIRB's seven step protocol towards obtaining final environmental remediation of the Property.

Pursuant to the seven steps, DuPont submitted to SIRB a document, dated May 14, 2004, and entitled "Final Remedial Investigation/Risk Assessment Report-Cherry island Landfill-Iron Rich Staging Are/Hay Street Sludge Drying Site (DE-024)"("RI/RA"). The RI/RA followed the Department's protocols for such studies, as set forth in the HSCA Regulations, and the Department's "Hazardous Substance Cleanup Act Guidance Manual." The Department's RI/RA is based upon the site investigation used by United States Environmental Protection Agency ("EPA") for similar federal investigations. DuPont's Corporate Remediation Group in alliance with its contractor, URS Diamond, prepared the RI/RA, which set forth various remedial scenarios and concluded that "the interim measures appear to be adequate for protection of human and ecological receptors, but that additional remedial action will be considered to meet long-term management goals." The RI/RA also set forth the remedial action objectives ("RAO") as:

1) Minimize human and ecological exposure to IRM and historic dredge spoils;
2) Minimize migration of IRM and its contaminants of concern iron, manganese, hexachlororbenzene, and polychlorinated biphenyls ("PCBs");

3) Minimize further migration of iron and other contaminants to the groundwater;

4) Prohibit the withdrawal of groundwater for other than environmental monitoring purposes; and

5) Prohibit the use of the Property for residential or unrestricted uses.

The RI/RA also set forth the following qualitative objectives:

1) Capping the IRM to minimize human exposure to meet Department carcinogenic risk standard or 1.0 x 1/100,000 or a hazard index of 1.0 or less.

2) Establish adequate stormwater retention area adjacent to the IRM;

3) Minimize IRM discharge into the adjacent waters and any discharge should meet EPA Ambient Water Quality Criteria;

4) Place deed restrictions on the Property prohibiting groundwater withdrawal except for monitoring and any use except for industrial purposes;

5) Develop a groundwater monitoring program for the contaminants of concern with maximum concentrations allowed being 726,787 mg/l for iron, 242,262 mg/l for manganense and 1.9 mg/l for hexachlorobenzene.

The Department approved DuPont's remedial action objectives in a May 20, 2004 letter, which was the second step in the VCP's seven regulatory steps. Consequently, DuPont submitted a "Focused Feasibility Study," ("FFS") dated June 18, 2004, which DuPont again prepared following the Department's regulations and guidance documents and to comply with the third regulatory step in the VCP agreement. The FFS developed remedial action alternatives and studied them based upon the remedial action objectives.

The Plan recommends the environmental remediation of the Property based upon the RI/RA and the Department's experts' independent review of the IRM, the dredge material ("DM") underneath the IRM, and the groundwater. The review of IRM determined the following contaminants of concern at the Property: arsenic, iron, manganese hexachlorobenzene,

vanadium and total PCBs. The levels exceeded the Uniform Risk-Based Remediation Standard ("URS") values, as set forth in the Department's December 1999 Remediation Standards Guidance Document. The drill borings of the dredge materials found levels in excess of URS values for iron and manganese. The water samples from monitoring wells showed excessive levels of iron, manganese, and chloride.

The Plan applied the site risk evaluation using the Department's Site-Specific Standard Calculator for Multiple Analyses. In addition, the Department relied on a 2003 Risk Evaluation Study performed by DuPont's contractor, Environ. The risk of cancer from the IRM was determined to be 1.99x 1/100,000, which exceeded the Department's acceptable risk limit of 1.00x 1/100,000. For non-carcinogenic risk, the IRM was determined to pose a Hazard Index ("HI") of 0.96 based upon restricted land use, which is within the Department's standards for an acceptable level of risk. Consequently, the Plan indicated that a remedial action is necessary to reduce the carcinogenic risk.

The Plan's analysis of the DM indicated that carcinogenic risk was 1.96x1/1,000,000 and the Hazard Index 0.26, which were within acceptable limits and, consequently, no remedial action was required.

The Plan's analysis of groundwater from shallow, intermediate and deep samples showed no carcinogenic excessive risk in the downgradient wells, but the contaminants of iron, manganese, and chlorides showed an unacceptable HI under the URS.

The Plan considered two options as possible remedial actions: 1) to cap the IRM and place institutional and engineering controls and 2) to remove by truck and dispose of the IRM and DM at another location. SIRB recommended option one, or cap in place, as the remedial action that would the RAOs and achieve the environmental remediation's objectives in the most efficient manner as required by the law and regulations. The Plan's cap in place remedial action would entail constructing a capping system over the IRM using a multi-layer system. The Plan

proposes a geomembrane fabric being placed over the IRM. The second layer would be a drainage layer. The third layer would be a soil layer, and the surface layer would be vegetative cover. In addition, there would be a system of stormwater and surface water controls subject to further Department approval by the Division of Soil and Water Conservation. The Plan would require DuPont to submit the cap's plans for Department review and approval within 90 days of Final Plan approval. The Plan also would require that DuPont place deed restrictions often included in the Department's final plans of remedial actions, such as, prohibiting residential or unrestricted use of the Property, drilling, constructing, digging, etc on the Property without Department approval, and drilling of any water wells on or the use of groundwater from the Property without Department approval. The Plan's third component was to require DuPont to submit within 90 days of Final Plan approval an operation and maintenance plan which includes a groundwater monitoring program, cap system inspection and evaluation every five years to ensure long-term integrity of the remedy.

When the Department issued the Plan the Department provided public notice of a public comment period beginning December 20, 2004 and ending January 10, 2005. It also provided notice of a public meeting to be held on January 7, 2005 at the Brandywine Hundred Fire Company. Based upon the public participation, at the January 10, 2005 public meeting, including requests for a public hearing and more time for public comment, the Department re—opened the public comment period beginning February 2005 and held a public hearing on 6:00 p.m., March 2, 2005 at the Edge Moor Community Center in Edge Moor, New Castle County. Due to the large number of participants who attended the March 2, 2005 public hearing, the hearing was continued for two more nights on March 3 and March 9, 2005. Following extensive public comments from many of the public participants, the Department extended the public comment period for written comments until April 8, 2005.

On May 3, 2005, House Resolution #22 was introduced and passed as House Concurrent Resolution #22 ("HCR#22") by the Delaware House of Representative and Delaware State Senate on June 2, 2005. HCR#22 stated in pertinent part as follows:

> BE IT RESOLVED by the House of Representatives and the Senate of the 143rd General Assembly, that the Dupont Company is hereby requested to fund an independent, third-party evaluation of the "Iron Rich" pile, to include a risk assessment, in order to assist the Department of Natural Resources and Environmental Control in the decision-making process with regard to the proper final disposition of the material.
>
> BE IT FURTHER RESOLVED that, if Dupont elects to fund such a study, the Department shall select the evaluating entity and shall coordinate and administer the contract to the extent that the Department shall delineate the scope of the inquiry and the timeframe for completion.
>
> BE IT FURTHER RESOLVED that any report resulting from the independent evaluation shall be made a part of the public record of the larger inquiry into the matter by the Department and that there shall be a period of 30 days for the public to comment in writing about the report and such public comment shall also be a part of the public record.
>
> BE IT FURTHER RESOLVED that the Department shall use the supplemented public record as a part of its decision-making process for the ultimate disposition of the material.
>
> BE IT FURTHER RESOLVED that, until such time as the third-party evaluation is complete and a decision may be made regarding the ultimate disposition of the material, the Department shall require, as a part of its regulatory oversight of the material, that Dupont continue to maintain its current interim measures to ensure protection of human health and the environment.

Following this resolution, DuPont agreed to fund an independent study and the Department used public contracting procedures, including two solicitations. The Department retained Schnabel Engineering North LLC ("Schnabel") on March 10, 2006, which submitted its independent study in a Report dated December 20, 2006 ("Report"). On February 1, 2007, the Department published notice that the public comment period was re-opened and allowed comments until March 2, 2007 consistent with HCR#22.

The Report identified certain concerns and deficiencies in the information and submittals relating to the IRM, DM, groundwater, RI/RA, and FFS. The Report indicated that more study

of the DM and IRM should be done through additional sampling and testing and that DuPont should update the RI/RA and FFS for the new data. The Report indicated that the groundwater impacts were not fully characterized and that there is a lack of groundwater data from within the IRM footprint and that prior sampling did not include hexachlorobenzene ("HCB") and hexachlorobutadiene ("HCBD") and that tests should be done for these potential constituents of concern. The Report indicated that the IRM was not sufficiently characterized to allow for the effective risk assessment of the proposed remedy based upon on-site hydraulic conductivities and whether there is HCB present in the IRM as a dense non-aqueous liquid, which the Report indicated may have a significant impact on the evaluation of an acceptable remedial action.

The Report indicated that the risk assessment would need to be revised for the deficiencies in the IRM and DM characterization and data. The Report also indicated deficiencies in the assessment to the extent it did not include migration of constituents of concern to the surface waters. Moreover, the operational practices of the Property exposed workers to increased risk than the assumptions used in the RI/RA. The Report criticized the RAO, in which they allowed levels of iron, manganese and HCB that did not appear to be protective of human health and the environment. The Report found that the life of the geomembrane cover was overstated and that source removal by rail transport was not exhaustively evaluated.

DuPont submitted a work plan for supplemental investigation on August 13, 2007, and performed the additional sampling. On September 8, 2008, DuPont submitted a draft RI/RA to reflect the changes based upon the sampling. On November 5, 2008, Schnabel sent the Department a review of the RI/RA. DuPont submitted an Addendum to the RI/RA on December 8, 2008, and a response letter to Department comments on December 11, 2008. SIRB conditionally approved the RI/RA Addendum in a December 18, 2008 letter and indicated the administrative record was complete. I requested the technical assistance of SIRB to assist in the technical analysis, and SIRB provided a technical response memorandum, dated January 14,

2009, a copy of which is appended hereto ("SIRB Memo"). The SIRB memo re-affirms that the remedial action as proposed in the Plan should be adopted, but that a separate investigation of the groundwater and DM at the Property and nearby sites would be appropriate as separate operable units under HSCA.

II. PUBLIC HEARING SUMMARY

The public hearing record consists of a verbatim transcript and documents submitted as exhibits. The Department submitted into the hearing record certain relevant documents, including the Plan, and the legal notices and other relevant documents, but not the entire administrative file.

The public comments presented during the public hearing may be summarized as raising public health and environmental concerns with the IRM and the Plan's proposed cap in place remedial action. The concerns were of movement of IRM into the adjoining waters by air transport by dust, by surface water runoff into the stormwater system, and by groundwater transport by draining into the subsurface. Most of the public comments supported the removal of IRM from the Property and its final disposal in a landfill. One comment, by a former DuPont employee, recommended that the IRM be entombed in concrete at the Property in order to provide the best protection and avoid the risk associated with further transportation. This person also raised a series of concerns with the toxicity of dioxins in the IRM and whether there was any radioactive material included based upon his experience that the Edge Moor plant had radioactive materials.

The public comments received after the Report supported the recommendations made in the Report. These comments again stressed that the Department should select the removal of IRM as the remedial action in the final plan. Some comments raised questions with the independent nature of the Report, the Department's procedures and sought more opportunity for public participation.

III. DISCUSSION AND REASONS

The role of the public hearing is to hear from the public on a proposal before a final decision is made. This proceeding highlights how public comments formed an important part of the Department's decision-making process. Indeed, the public hearing process caused the Department to revisit and review the Plan based upon further post-hearing investigation as contemplated by the public hearing process. The Department, assisted by DuPont's funding of an independent study and DuPont's RI/RI Addendum, and the Report and additional public comments based upon the Report, has produced an enormous administrative record to support a decision on the Plan. Based upon my review and research, including a tour of the site, I recommend that the Plan be adopted as a Final Plan.

First, I address the procedural questions that were posed during the public hearing process, including the request for party status and for additional public hearing or opportunity to comment. In my opinion, the Department's role is to develop an administrative record to be available for the Secretary's review, and that the administrative record includes the public hearing record. The public hearing is to allow public comment on one portion of the administrative record, namely the Plan. *7 Del C. Chapter 60* provides the Secretary with the authority to preside over public hearings and grants authority to investigate, which I submit is not limited to an investigation before a public hearing. Indeed, the Plan was subject to considerable investigation after the public hearing, which I consider to be consistent with the broad investigatory powers granted the Department. Unless the Department can investigate allegations raised in a public hearing, the value of public comments would be greatly diminished and the public hearing would be a mere formality for the public to make comments that the Department would be powerless to act upon by further investigation. Thus, while the public comments may seek to hold another public hearing based upon the additional investigation, I do not recommend such action. The further investigation has resulted in the Department's experts concluding that

there is less risk than originally determined. Consequently, more research while the IRM remains not covered by an engineered cap is not prudent, although additional research may continue on the DM and groundwater if the Plan, as modified by the public hearing process, is adopted. Instead, I recommend that the Secretary determine that the investigation and the administrative record are sufficiently complete and that the Plan is ready for a final decision.

The Secretary may rely upon the much larger administrative record developed by such a post-hearing investigation in making a decision to either adopt the Plan, reject the Plan, or adopt the Plan with conditions or changes that the Secretary determines are appropriate and consistent with the law and Department policy. A Plan may be changed by the Secretary without further public hearings because the law does not require an opportunity for further public comment, unlike the opportunity to comment on substantive changes to proposed regulations.

The issue of the IRM and the DM on the Property was the subject of a consent order and also of a VCP agreement. If the Plan conflicted with these, then a legal issue would have been presented earlier than in this report of recommendations. I consider that the final plan with a remedial action other than cap in place could provide grounds for the Department to seek relief from the Superior Court's consent order. Whether Superior Court would provide the relief is obviously an open question. The grounds for relief would be based upon the new information. The VCP agreement contemplated a seven step process, including the entry of a final order that could direct a different remedial action than contemplated when the VCP agreement was executed. Thus, I raise this important issue because the public comments raised this perception issue, but in my opinion I do not consider the consent order or VCP agreement as binding upon the Department in its subsequent decision on the Plan or any modification to it, but if the final Plan directs removal, then the Department likely may have to seek relief from the Court's consent order.

The substantive issue raised by the public comment is whether the Plan provided an adequate remedial action based upon the cap in place remedial action. I rely on the technical expertise of the Department's experts, particularly in the SIRB memo prepared after all the post-hearing investigation was concluded in December 2008. The SIRB memo is comprehensive and detailed in its response to the various scientific concerns raised by the public comments. I incorporate the reasoning and offer only additional discussion on certain salient points that were raised in the public comments.

First, I find that the Property has been thoroughly investigated. The Report, including as supplemented by the RI/RA Addendum, indicate an expert opinion that certain inadequacies remain in the investigation. My review finds the inadequacies to be one of materiality and level of detail, not one that would warrant rejection of the Plan in favor of the removal option. The problems with the DM and groundwater will continue to be addressed in the Department's continued investigation of the Property and the surrounding area, as recommended by the Department's experts. I consider that the Study was complete for the purposes of acting on the Plan, although experts may differ on the level of additional scrutiny of the Property. The public comments that questioned the "independence" of the Report should be silenced by the fact that the Report was critical of the Plan to the extent it was not based upon even further additional study than the Department's experts already are recommending. I study the Report was an appropriate exercise and added considerable value to the Department's record, but it does not change the support for the Plan and did not provide any dramatic revelation. Indeed, the Report confirmed the lack of any trace of most toxic form of dioxin or any radioactive material, which had be claimed to be present in the public comments. DuPont's use of in-house experts may have allowed the public to cast certain suspicions on the work performed in the RI/RA and FFS. The Report did not, in my opinion, produce any findings that contradict the earlier findings regarding the presence, concentration, exposures or risks of hazardous substances at the site, but

recommended additional data collection and analyses to fill observed data gaps to provide greater certainty about the proposed remedial action. The Report did not find any basis for concerns about imminent risks to human health or the environment.

The Plan's cap in place is equivalent to the regulatory steps the Department took to ensure that the public health and the environment are protected from undue risk in other similar sites. I agree that the protection afforded by the cap in place remedy should be at least equivalent to the protection afforded by other Plans approved by the Department or even for closed industrial landfills, which is what the Plan's cap in place remedy contemplates.

The public comments of the former DuPont employee require certain discussion because his comments unquestionably cause fear about the presence of one type of the more than one hundred dioxins, which he described as the most dangerous poison or substance known to mankind. He also raised the issue of the Property containing radioactive material. The exhaustive study of the Property has convincingly and conclusively refuted these claims. If I was to make a finding on credibility, which I am not, I would have some concerns about the motivations of the former employee that prompted his comments on the highly toxic nature of the IRM when further investigation disproved his comments. Nevertheless, he recommended as a remedial action that the Department entomb the IRM with concrete or by mixing it with concrete. The SIRB memo addresses this alternative and rejects it as unnecessary and that the geomembrane cap provides sufficient protection. I agree based upon the lower risk of exposure to hazardous materials than he claimed and the problems with concrete as discussed in the SIRB memo. His recommendation was at odds with the other comments that sought removal.

The Report indicated that removal by truck transport to the DuPont Edge Moor Plant and then train transport should have been considered more exhaustively as an option. I agree in concept that such a remedial action should have been considered in greater detail, but based upon the administrative record I conclude that the cap in place remedial action provides a more

reasonable remedial action based upon the application of the selection criteria, which includes cost considerations. The Department is not required to select the best remedial action if it imposes an undue cost and other lower cost alternatives will result in lowering the risk from the hazardous substances to an acceptable level. The removal option is more costly and the end result would have the Property returned to level of environmental cleanup that the law does not require. The law requires limiting the environmental risk to within specified standards and limits and the cap in place remedial action accomplishes this goal at the least cost, which the Department is obligated to factor into its decision. Any other selection would provide DuPont grounds to appeal based upon the Department not complying with its own regulations and guidelines.

Finally, the Department's regulation of the Property will continue and the approval of the Final Plan will begin the clean-up, which has been unduly delayed by the further investigation. The cap in place remedial action could have been in place by now, but I agree that the additional almost four years has provided a degree of assurance warranted by the degree of public concern.

IV. RECOMMENDED FINDINGS AND CONCLUSIONS

Based on the record developed, I find and conclude that the record supports approval of the issuance of the Plan as a final Plan of Remedial Action, subject to the reasonable continued investigation as contemplated in the SIRB memo. In conclusion, I recommend the Secretary adopt the following findings and conclusions:

1.) The Department has jurisdiction under its statutory authority to make a determination in this proceeding;

2.) The Department provided adequate public notice of the proceeding and the public hearing in a manner required by the law and regulations;

3.) The Department held a public hearing in a manner required by the law and regulations;

4.) The Department considered and responded to all timely and relevant public comments in making its determination;

5.) The Department continue to investigate the groundwater and dredge material as part of a further investigation in such operable units as may be determined; and that

6.) The Department shall provide adequate notice of the final action to those affected persons and public notice in a manner required by law or regulations, including the right to appeal the final decision.

s/Robert P. Haynes
Robert P. Haynes, Esquire
Senior Hearing Officer

DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
DIVISION OF AIR AND WASTE MANAGEMENT
SITE INVESTIGATION & RESTORATION BRANCH

MEMORANDUM

TO: Robert Haynes, Senior Hearing Officer

THRU: James D. Werner, Director DAWM
Kathy Stiller, PMII SIRB
Qazi Salahuddin, PM I SIRB

FROM: Wilmer Reyes, Environmental Engineer IV SIRB

DATE: 01/14/09

SUBJECT: Technical Response to Public Comments on the Hay Road "Iron Rich" Sludge Drying Site (DE 0024)

The following technical response was prepared to assist in the Hearing Officer's Report to address public comments on SIRB's Proposed Plan of Remedial Action for the Hay Road Iron Rich Sludge Drying Site. The response also addresses comments raised by the Independent Study performed by Schnabel Engineering, Inc. as a result of the 2005 House Concurrent Resolution #22. These responses are based on all the study and investigations performed for the site including the December 2008 Supplemental Remedial Action/Risk Assessment (RI/RA) investigation performed as recommended by the December 2006 Independent Study. Based upon our review, SIRB does not recommend any substantive change to the 2004 proposed plan. Accordingly, we recommend that the proposed plan be approved as the Final Plan of Remedial Action with relatively minor refinements. To address the minor changes resulting from our review, SIRB/DAWM recommends that the Secretary consider the following changes to be made in the Final Plan of Remedial Action:

- Development of a broader area-wide groundwater monitoring program will include further evaluation of the hydrogeology and chemistry of the underlying dredge material and groundwater to determine the potential impact to the surrounding environment including Shellpot Creek. The potential impacts may include ecological impacts to natural resources. No public health risks appear to exist. This groundwater evaluation effort should include not only the DuPont Site, but a larger scope of study involving a variety of sites under which a similar dredge material exists.

- The site-related contaminants present in the Shellpot Creek along with the contaminants from other sources will be addressed through the Shellpot

Creek initiative, Delaware Estuary Program and DNREC's Natural Resource Damage Assessment.

The following public comments and responses have been summarized by general topics and not by individual comments so as avoid repeating essentially identical issues and comments.

Comment 1: *Dioxins, furans and PCB compounds are present in Iron Rich Material (IRM) pile and the underlying Dredge Material (DM) at high concentrations and present a significant risk to human health and the environment. The site has been referred to as the "dioxin pile" by some members of the public and the news media because of this concern, particularly over whether there were any toxic dioxins.*

Response 1: The term "dioxin" typically refer to particular compound (2,3,7,8-tetrachlorodibenzo-p-dioxin", or "TCDD"), which is know to be a persistent and potent toxic chemical. Repeatedly detailed testing of the *Iron Rich* material in and around the DuPont site have indicted that there is no trace of any "dioxin" (TCDD) present at limits of detection at parts per trillion detection limits. Part of the factual confusion may have arisen as a result of the categorization by EPA, which established category of chemicals for testing referred to as "dioxins, furans and PCBs."

Dioxins and furans are a group of dozens of chemical compounds with widely varying toxicities and persistence characteristics. The most toxic of these compounds is 2,3,7,8-tetrachlorodibenzo-p-dioxin ("TCDD"). The test results showed that TCDD and the other DNREC regulated dioxin compound 1,2,3,7,8,9-HxCDD were not detected in the *IRM*. In samples of the dredge material, however, these compounds were detected at concentrations at least ten times lower than DNREC's risk based standard and therefore pose no potential health risk. Sediments along the Shellpot Creek also showed low concentrations of these compounds and the ecological risk is recommended to be further evaluated. However, these contaminants showed different dominant components from the contaminants detected in *Iron Rich* material and indicates that they appear to have come from other potential sources. Other studies of toxics in the Delaware River indicate a pattern of dioxin concentrations from a variety of upstream, watershed and global sources that have accumulated in river sediments.

Other dioxin-like compounds are present at concentrations that are too low to pose any potential health or ecological risk, based on risk assessment using evaluation methods to compare the toxicity of these widely varying compounds. For example, one "dioxin-like" compound (octa-chlorinated dibenzo-p-dioxin "OCDD") is approximately 3,000 times less toxic that TCCC-dioxin. Hence, the toxicity of the dioxin and dioxin-like compounds of much lesser toxicity than 2,3,7,8 TCDD is reported as Toxicity Equivalent Quotient (TEQ) of 1/3,000 of TCDD because it is that much less toxic than if the mixture were pure TCDD. The TEQ approach has been adopted by EPA and scientists internationally as the most appropriate way to estimate the potential health risks of mixture of various families of compounds, like dioxins. Total TEQ results for the *IRM*

pile and dredge material were calculated below the EPA standard level. TEQ for *IRM* was calculated at 1.87 parts per billion (ppb) and for the DM at 0.06 ppb. The EPA regulatory standard is 5 to 20 ppb for commercial/industrial use. In sum, after extensive testing using internationally-recognized scientific methods, with detection limits at parts per trillion concentrations, the additional testing and analysis during the past four years has confirmed that there is no evidence of any TCDD dioxin in the *IRM* pile. Moreover, the other less toxic forms ("congeners") of dioxin are present at such low concentrations as to pose no potentially elevated risk to human health.

PCB compounds were detected in the *IRM* and DM at concentrations below the DNREC standard of 1 part per million (ppm) except for one *IRM* split sample with 1.1 ppm and one DM sample with 1.22 ppm. The dominant PCB congener present in *IRM* is PCB 209 (decachlorobiphenyl). PCBs are included as one of the contaminants of concern because PCBs, particularly PCB 209, are observed in surrounding environmental samples.

Comment 2: *Schnabel Engineering in the Independent Study commented that Hexachlorobenzene could potentially be present as a free product in the IRM and therefore, was a concern for this compound to migrate from the pile.*

Response 2: Hexachlorobenzene is not present as free product in the *IRM* as confirmed by the Supplemental Investigation (SI), which Schnabel reviewed and agreed with the conclusion. Hexachlorobenzene is, however, present at a low concentration of 19 ppm in *IRM* as detected during additional sampling. The DNREC's Uniform Risk-based Standard for protection of human health for hexachlorobenzene is 4.0 ppm. In addition hexachlorobenzene was not detected in the dredge material. This indicates that vertical migration from Iron Rich material to dredge material has not occurred. Hexachlorobenzene was included as a contaminant of concern for the IRM.

Comment 3: *Radiation is believed to be present at the site at high concentrations and may impact human heath and the environment. Additional information about radionuclides potentially present in the natural decay series of uranium and thorium in the pile was requested.*

Response 3: Response to radiation issues was provided by DuPont in a letter to Mr. Haynes, the DNREC hearing Officer, dated April 5, 2005. DuPont's response was reviewed by Schnabel during Independent Study and Schnabel stated that DuPont's response adequately addressed the concern. DNREC agrees with this conclusion.

Comment 4 : *Contaminants present in the IRM and dredge material are impacting groundwater at the site and the impacted groundwater in turn discharges to the Shellpot Creek and Delaware River causing surface water and sediment contamination.*

Response 4: Organic compounds were not detected in groundwater at the site except for low concentrations of octachlorodibenzofuran (OCDF) and PCB in the unfiltered groundwater sample at a concentration 100 times lower than the regulatory standard. In

addition, when the sample was filtered these organic compounds were not detected and it was concluded that organic compounds are not present in groundwater. The only inorganic compounds present in groundwater above DNREC standard are iron, manganese, arsenic and vanadium. These inorganic compounds are present in the *IRM* and DM but are also present regionally in the groundwater. The proposed groundwater monitoring program will further evaluate these contaminants.

The potential of groundwater contamination from any future leaching of contaminants from *IRM* and DM was evaluated using with leachability test for the inorganic and organic compounds in *IRM* and DM. Based on leachability test results, conservative modeling and mass loading calculations, as well as the chemical composition of the *IRM* pile indicated that the contribution of the organic and inorganic contaminants present in the *IRM* pile to the underlying dredge material is minimal to none. Leachability test performed in a DM sample indicated that some metals in the DM have the potential to leach from the DM to the groundwater. Mass loading calculations was performed for the contaminants already present in groundwater to determine its impact to the surface water. Iron concentrations present in the groundwater exceeded the surface water quality standards in Shellpot Creek under low flow conditions. However, iron is also present regionally in the groundwater and a monitoring program will be developed to address these concerns. Based on the monitoring results, additional measures may be taken, if needed.

Comment 5: *Contaminants from the site is impacting the surrounding surface water, sediment and fish in the Shellpot Creek and Delaware River.*

Response 5: Site-related contaminants are presents in the surface water, sediment and fish in Shellpot Creek. Some of these contaminants are detected above Delaware Surface Water Quality Criteria. Contribution from the *IRM* pile to this contamination is believed to be mostly historical, through wind dispersion and drying operation of the iron rich material at the site, before application of temporary coating to the Iron Rich pile and surface runoff. The data, however, showed that contamination in Shellpot Creek is a mixture of site related and non-site related contaminants, but the presence of non-Iron Rich material related contaminants is more significant.

Because of the historical contribution of the *IRM* to the contamination in Shellpot Creek and the contribution from other potential sources, DNREC is proposing to address this issue though the Shellpot Creek Initiative (in coordination with the Delaware Estuary Program and as part of a Natural Resources Damage Assessment (NRDA)).

Comment 6: *The Focused Feasibility Study (FFS) evaluated two remedial options for the site: capping of the IRM pile and off-site removal of IRM. Capping of the IRM proposed as the remedy in the Proposed Plan of Remedial Action will not effectively protect the human health and the environment.*

Response 6: The supplemental investigation provided data that supported and did not contradict the previous conclusion that engineering capping of the *Iron Rich* pile would meet the HSCA requirements for a protective remedy of the contaminants detected in the *IRM* pile. The remedial design of the cap and associated engineering controls will ensure the stability of the pile and address the runoff and storm water controls. Consequently, DNREC has concluded that the proposed capping remedy of the *IRM* pile will be adequate to protect human health and the environment from any contaminants in the pile. Because of some broader questions regarding the potential impacts of the dredge material on the environment, the Department is proposing further investigation regarding environmental impacts from the dredge material (i.e, iron, manganese and other compounds) as discussed above.

Comment 7: *The risk assessment is inadequate because (1) it failed to include every compound detected and only assess the potential risks from compounds detected above DNREC's screening values; (2) the risk assessment failed to assess the human health impacts of the potential exposure of people living or working downwind of the site; and (3) the risk assessment failed to consider adequately the ecological risks.*

Response 7: These risk assessment issues were, in fact, considered as part of the initial site review, and were evaluated further as part of the Independent Study.

The well-accepted scientific methodology under HSCA (DNREC 1999 Remediation Standards Guidance under the Delaware Hazardous Substance Cleanup Act) is to perform risk assessments initially based on an evaluation of the risks of a subset of the complete range of compounds detected, and to consider instead only those compounds detected at concentrations above a "screening level." These screening levels are set at concentrations ten times lower than risk-based cleanup standard. Hence, using this very conservative (i.e., protective) method, if the observed concentrations of these screening compounds are below these screening levels, then, logically, there is no need to evaluate the potential risk of additional compounds observed at far lower concentrations with lower toxicity values.

The risk assessment did, in fact, evaluate the potential risks to both human health for any potentially exposed population. Again, the methodology used was a well-accepted and conservative process that considered first, the most exposed individuals at the highest concentrations possible. Using this conservative methodology, the Department determined that a cap remedy was warranted to protect human health for any potential exposure, including individuals who might be in contact with the material while working on the pile (i.e., temporary on-site workers). A more detailed risk assessment, however, indicated that the site posed a substantially lower risk to human health than this initial conservative assessment estimated. Nonetheless, the Department recommends installation and maintenance of a protective cap as part of the remedy as a conservative protective measure.

Accordingly, if there is no significant risk to workers at this close proximity, assuming they would be exposed solely to the highest concentrations of the combination of the most toxic compounds found at the site, then we can reasonably conclude that the remedy would also be protected for protective human health at locations further from the site. This is a commonly used logical process we believe provides a high degree of conservatism and protectiveness at this site. In fact, the risk assessment concluded that there was no significant direct human health risk from direct exposure to the *Iron Rich* material, but that a cap was warranted as discussed above.

The evaluation of the potential ecological risks from the site will require additional consideration of the area-wide contributions within the Shellpot Creek water shed, which is exactly what the department has initiated. The potential ecological risks appear to be part of the overall contributions from a variety of sources, including the dredge material and inputs from other sites. The potential ecological impacts from the IRM pile will be addressed adequately by installation and maintaining a protective cap over the pile. To address the potential ecological impacts from the underlying DM, the Department is recommending an area-wide assessment of the dredge material around the Shellpot Creek, as well as within the overall Delaware River assessment and the Natural Resources Damages Assessment.

Comment 8: *The long operational life of the geo-membrane and the lack of bottom liner was questioned.*

Response 8: This concern was addressed by DuPont in their response document DuPont Comments to Schnabel Engineering Report dated March 2007. Based on the document, which was reviewed by Schnabel, the operation life originally stated is correct. A bottom liner is not needed since the vertical migration of contaminant from IRM is minimal to none. In addition the vertical hydraulic conductivity of the underlying dredge material is low.

Comment 9: *Schnabel commented that there was a topographic low in the berm surrounding the site and this low point could potentially be vulnerable to flooding.*

Response 9: Based on the information provided in the DuPont response document "DuPont Comments to Schnabel Engineering Report dated March 2007", topographic low of the berm corresponds to an elevation of approximately 9.0 feet MSL NAVD88 at the base of the rip-rap at outfall D002 (south east corner of the site). DNREC determined that this localized topographic low increases in elevation to a 16 feet MSL and is not a flooding concern.

DNREC has reviewed the topographic maps provided by DuPont and the FEMA flooding maps. Based on this review, flooding for the 100 and 500 year are believed to have no direct impact on the Iron Rich pile.

Comment 10: *Capping of the IRM pile will impact groundwater hydrology by changing flow patterns which in turn will influence contaminant movement.*

Response 10: Based on current condition, main groundwater flow of the upper water-bearing zone is towards the Shellpot Creek while flow in the lower aquifer unit is towards the Delaware River. Further evaluation of the dredge material and the water bearing zone will be part of the proposed monitoring program for the site. The monitoring program will require assessment of the hydrologic unit for the site in conjunction with the adjacent landfill area (the 3 cells). Additional remedial measures may be taken based on the results of the monitoring program.

Comment 11: *The number of samples presented in the 2005 PPRA was considered to be insufficient for DNREC to make conclusions about the contaminants of concern and proposing a remedial action for the site.*

Response 11: A sampling work plan was developed to address sampling requirements. The work plan was also reviewed by Schnabel. Additional multimedia samples were collected as part of the Supplemental Investigation (SI) based on the work plan. Samples were collected from underneath the footprint of the pile, so they are representative of current environmental conditions.

In addition to samples collected as a part of the SI, DNREC has used available data from other sampling events from other programs in order to complement data results. Specifically, results from the monitoring program for the landfill cells have been used in the assessment.

Overall, DNREC believes that sufficient samples has been collected at the site and provide a complete survey and informed understanding of site conditions. Additional samples are planned to be collected as part of the proposed monitoring program for the site. More samples may be collected as part of the Shellpot Creek and NRDA initiatives.

Comment 12: *One commenter recommended not removing the material but instead using concrete to stabilize the material on site.*

Response 12: A variety of possible remedial alternatives were raised in public comments, including a remedy whereby IRM was stabilized by mixing it with concrete (the proposal was never clearly described in any technical detail). The technical program staff considered this among other remedial alternatives and concluded that these did not offer any increased protection to human health or the environment, compared to the proposed engineered cap identified in the proposed plan. In fact, the concrete cap/solidification alternative could result in less desirable environmental impacts because of the difficulty and cost of maintaining such a concrete system over the long run. A concrete stabilization would require more frequent repair to correct cracks that could develop in freeze-thaw cycles. Moreover, a concrete stabilization would cause sheet flow storm water run off that would resulting in more sudden increase of nearby surface water

flows. The proposed remedy is a well-establish system using a soil cover with geo-membrane and drainage layer that provides more reliable maintenance and more environmentally benign impacts compared to a concrete stabilization. Accordingly, we considered but dismissed this remedial option as being a preferred alternative for environmental protection.

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